SUBJECT: Trip Report - LM/ATM Task Team Status Meeting, MSC, January 5, 1967 Case 600-3

DATE: January 12, 1967

FROM: W. W. Hough

ABSTRACT

A LM/ATM interface task team, with members from MSC and MSFC, held their first status review at MSC on January 5, 1967. The team is divided into disciplinary groups, four of which gave reports.

The mission analysis group discussed problems of insufficient AAP-3 performance margins and excessive CSM RCS requirements. Their analyses are based on a three-rendezvous mission which is necessitated by inclusion of a Resupply Module in the AAP-3 mission. Deletion of the Resupply Module with consequent elimination of a rendezvous results in positive performance margins. If a requirement for RCS backup deorbit capability is also deleted, RCS requirements fall more in line with existing capability.

MSC anticipates that the entire Orbital Assembly will run 20°-30°F on the cold side. Lack of a complete thermal analysis is preventing them from specifying LM A-S power requirements which, in turn, is delaying MSFC in their design of the LM/ATM power system. Antenna location to provide continuous telemetry over ground stations is also a problem. Existing antennas are insufficient in the Assembly configuration. An integrated set of antennas located on various components of the Assembly will probably be required.

BELLCOMM, INC.

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MEMORANDUM FOR FILE

A meeting to review the status of the work of a task team for the LM/ATM interface was held at the Manned Spacecraft Center, Houston, Texas on January 5, 1967. The task team was created by Mr. George M. Low of MSC and Dr. Eberhard Rees of MSFC and is to report to them on the problems and configuration of the LM/ATM interface by the end of January. The team is chaired by J. A. Chamberlin of MSC and G. B. Hardy of MSFC and is divided into disciplinary groups with members from both Centers. The four groups reporting were:

1. Mission Analysis
2. Electrical
3. Control and Display
4. Instrumentation and Communications

Additional groups for study of structures and dynamics, thermal control, guidance and control, and test and checkout are being formed.

The mission analysis discussion was led by Dick Parten of MSC/MPAD. The major problems exist with the AAP-3 performance margin and with CSM RCS requirements. MPAD's analyses have been based on a three-rendezvous mission: (1) CSM-Resupply Module rendezvous with the Workshop (2) CSM rendezvous with the LM/ATM (3) CSM-LM/ATM rendezvous with the Workshop. Five cases, differing as a function of whether the SPS or RCS is used to perform the first rendezvous, and whether RCS propellent is included for backup deorbit have been analyzed. Attachment 1 gives RCS and SPS propellent quantities for these cases. In all cases, the RCS fuel requirement is greater than the 1224 pounds CSM capacity. If a Resupply Module is not used, one rendezvous is eliminated with a saving of between 400 and 450 pounds of RCS fuel. With no RCS deorbit capability and using the SPS for Terminal Phase Initiation (Case 2 in Attachment 1), RCS propellent requirements are approximately equal to the present capability.

Reliability of SPS deorbit for a 56-day earth orbit mission is not considered sufficient; this is due primarily to a thermal problem, i.e., propellent line freezing. If the SPS reliability problems are not solved, then either a solid retro or RCS deorbit capability must be added. Attachment 2, also prepared by MPAD, gives the performance summary for the AAP-3 and AAP-4 flights with the RCS required for deorbit included in AAP-3. (The Resupply Module, which implies a three-rendezvous mission, is also included.) Inert weight for the additional RCS tankage has not been entered however, and as this amounts to approximately 650 pounds, the AAP-3 payload margin in the case of on-time AAP-4 launch is also negative. This situation is avoided if the resupply provisions are moved to either the AAP-2 and/or the AAP-4 payload.

Thermal control of the Workshop, Airlock Module, and LM is a problem. MSC expects that the Assembly will run cold by 20°-30°F. If the internal volume must be heated electrically, excessive power requirements arise. Because a complete thermal analysis has not been done, the total power profile for the Assembly including the LM/ATM cannot be generated. Therefore sizing of the LM/ATM power system must be delayed. MSC will supply data on LM A/S-D/S interface circuits and on the LM A/S umbilical so that MSFC can evaluate existing capability with respect to ATM requirements.

Two locations within the LM cabin for the ATM control and display console have been identified by MSC. One location to the left of the tunnel requires modification to the crew restraint system. The other location requires a folding panel to provide the estimated 1142 square inch area; however, the astronaut would be facing away from the Ascent Stage windows when working at the panel.

There are no existing antennas on the vehicles comprising the Assembly that provide full telemetry coverage over ground stations. Furthermore, because of the geometry and flight attitude of the Assembly, there is no single vehicle where they can be added. MSFC agreed to make Lockheed and Martin reports discussing this problem and possible solution available to MSC.

Task team status meeting will be held weekly, with the next in Huntsville on January 13, 1967.

W. W. Hough

1022-WWH-mef

Attachments 1 and 2

Copy to
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ATTACHMENT 1

SPS AND RCS PROPELLANT REQUIREMENTS SUMMARY

211 - 212 Mission

(Now AAP-3/AAP-4)

Workshop Orbit - 255 circular

Function	CASE 1 SPS Deorbit - RCS TPI (1st Rend)		CASE 2 SPS Deorbit - SPS TPI (1st Rend)		CASE 3 RCS Circ. Deorbit RCS TPI (1st Rend)		CASE 4 RCS Circ. Deorbit SPS TPI (1st Rend)		CASE 5 3 min Launch Delay (IM-AIM) RCS Circ. Deorbit-SPS TPI (1st Rend)	
	SPS	RCS	SPS	RCS	SPS	RCS	SPS	RCS	SPS	RCS
1st Rendezvous	1845	642	1903	568	1845	642	1903	568	1903	568
2nd Rendezvous	219	347	219	347	219	347	219	347	689	347
3rd Rendezvous	60	502	60	502	60	502	60	502	1005	485
Workshop Attitude Control	0	180	0	180	0	180	0	180	0	180
Deorbit	1790	50	1790	50	1790[1]	1188[2]	1790[1]	1188[2]	1790[1]	1188[2]
TOTAL	3914	1721	3972	1647	3914	2859	3972	2785	5387	2768

1 It is necessary to budget the SPS propellant as the primary deorbit mode even though the propellant may not be expended.

2 Deorbit from an elliptical orbit with 175 nautical miles perigee will require approximately 700 pounds.